"Defense Modeling and Simulation"

Keynote Address of
The Under Secretary of Defense for Acquisition and Technology
Dr. Paul G. Kaminski
to the

DMSO Fifth Annual Industry Briefing on Modeling and Simulation
Radisson Plaza Hotel, Alexandria VA

May 22, 1996

Let me start my talk with a little bragging about the Department of Defense. Without question, the United States has the best led, the best trained, best equipped military force in the world today. I am really, very proud of this kind of excellence—we see it today all over our armed forces.

This excellence is the result of the high quality people we attract and retain, and it is also the result of about two decades of hard work and foresight in past investment decisions. My predecessors invested wisely in technologies in the 1960s and 1970s, and we have seen the results of their wisdom in the swift and decisive victory in Desert Storm; in the success of the NATO operation in Bosnia; and in our continuing ability to deter potential adversaries from acting against US interests.

Today the Department's senior leaders are equally committed to preserving the excellence of our armed forces. Modeling and simulation will play a critical and increasing role in training, equipping and making decisions about the composition of those forces.

M&S MASTER PLAN

I believe this industry day is timely because the Department of Defense, through adoption of a Modeling and Simulation Master Plan in October of 1995, has begun to move forward on a more coherent strategy for improving oversight and coordination of DoD modeling and simulation activities. In a budget constrained environment, we simply can not afford to waste dollars on redundant, stove-piped efforts—we need to be able to get more mileage out of the models and simulations we build.

In an environment that is increasingly joint, often coalition, and involving system of systems architectural trades, we must be able to link simulations together and interoperate them in federations. To do that we have to find ways to facilitate their interoperability and reusability. DoD modeling and simulation activities need to be anchored in a common technical architecture and interchange data which is both authoritative and means the same thing to everyone.

To be cost-effective, they must also share common infrastructure services like communication networks, a rapid means to access environmental databases, a distributed repository system to find and pull-down existing models and simulations, and a help desk to answer questions from users on setting-up a simulation exercise.

The cornerstone of our efforts for fostering interoperability and reuse is the High Level Architecture, or HLA. The establishment of HLA-compliant simulations will be an important milestone in maximizing the benefits of modeling and simulation across the Department of Defense. During the course of this industry day conference, I'm sure you will hear more about the many other activities underway to support implementation of this architecture.

For the remainder of my talk today, I would like to give you the Department's perspective on the use of modeling and simulation to improve training, decision support and weapon system acquisition.

TRAINING

Turning first to training, I was reminded of one of the reasons why our forces are so capable when I visited General Sheehan a few months ago at U.S. Atlantic Command Headquarters in Norfolk, Virginia. At that time, I had an opportunity to be briefed on and tour the Atlantic Command's Joint Training, Analysis and Simulation Center.

General Sheehan and the leadership of U.S. Atlantic Command have made extraordinary progress in using advanced modeling and simulation to train today's joint—and in some cases--combined forces for tomorrow's coalition missions. While I was there, I reviewed the progress of efforts to develop and implement a new joint program—the Joint Simulation System, or JSIMS.

JSIMS is a flagship effort—a cooperative endeavor of the Services, Joint Staff, and OSD. It will provide combined, joint and Service training for our warfighters—well into the 21st century. I understand that you will be hearing directly from the JSIMS Joint Program Office later today. While their challenges are significant, I see all of the services, the Joint Staff, and OSD working together as a team to make JSIMS a success.

We are just beginning to leverage advances in information technology, such as processing speed and advanced distributed simulation, to deliver more capable training environments. These technologies are enabling modelers to use more complex or granular models that execute in the same elapsed time as less-precise older models. High-speed communications permit models at remote sites to be run together and even support real-time and faster than real-time user interaction. It is becoming possible to link actual operational weapon systems as integral elements in a simulation. The driving enabler for physics based models is Moore's Law—an

empirical relationship that says chips have been getting twice as powerful every 18 months since 1970.

DECISION SUPPORT

Decision support is the second area that I want to comment on today. It is a growth area—a growth area in the sense that the Department needs to become a smarter buyer in both what equipment we buy and how we structure our forces. To determine what our forces will look like in the 21st century, the Department is placing considerable emphasis on being able to make the critical trades within system-of-systems architectures. Our goal is to select the most cost-effective mix of systems for development and fielding. No longer will we make program decisions in isolation.

I see us routinely making trades between on-board and off-board capabilities of individual platforms. This places a premium on having the analytical and decision support capabilities to evaluate the effectiveness of alternative options in simulated combat conditions.

Just within this past year, the 1995 Heavy Bomber Study looked at adequacy of the planned bomber force within the context of a two major regional contingency scenario, supporting tactical air forces and a mix of on-board weapons with varying capabilities against the simulated threats.

The Strategic Airlift Force Mix Analysis and Tactical Utility Analysis were used to evaluate the cost-effectiveness of various mixes of C-17 aircraft and non-developmental airlift aircraft (NDAA) to perform airlift missions in support of various contingency operations. This year a similar study is underway to evaluate the mix of accurate guided weapons being procured by the Department.

Without question, the Department will move to make greater use of simulation based evaluations of systems. As we do so, the Department must ensure that these assessments are made in a controlled and repeatable environment. For this reason, the Department is taking steps to establish such an environment, known as the C4ISR Decision Support Center for evaluating systems in a combined C4I (Command, Control, Communications, Computers and Intelligence) and ISR (Intelligence, Surveillance and Reconnaissance) environment.

The Department's program analysis and evaluation community is sponsoring the development of a flagship simulation program to help make system-of-systems trades—it is called JWARS, or the Joint Warfare System. JWARS will fold in functionality like command and control, intelligence, surveillance, and reconnaissance, allowing us to consider these important aspects in our investment decisions and operational course of action assessment, thus helping us make smarter decisions. I understand you will also hear more about JWARS later today.

As these examples illustrate, a hierarchy of models and simulations are used to help the Department make the "what to buy" decisions. At the engagement or system-on-system level, system effectiveness against an adversary system will need to be evaluated.

At the mission/battle or force-on-force level, the ability of a multiple platform force package to perform a specific mission will need to be evaluated. And finally, in theater/campaign level simulations, the outcomes of a conflict will need to be determined for a total package of joint and combined forces.

At the current time, I envision extensive use of constructive models and simulations for these system-of-system evaluations. Eventually, I see greater use of virtual simulations in which virtual prototypes are operated on synthetic battlefields.

WEAPON SYSTEM ACQUISITION

And this brings me to the third area where modeling and simulation is having a dramatic impact—it is changing the way we buy weapon systems.

We are institutionalizing our "how to buy" initiatives, including the use of virtual prototypes and modeling and simulation, in a new version of the Department's 5000 series acquisition regulations. The new regulation strongly encourages the use of models and simulations to improve quality and to reduce acquisition time, resources, and risks.

It also encourages embedding virtual prototypes in synthetic environments to support requirements definition, concept exploration, manufacturing and testing of new systems. The recent LPD-17 Early Operational Assessment, for example, used a CAD/CAM representation as its basis.

We have found that decision cycle times are improved when program managers and functional staffs have assess to modeling and simulation results. General Dynamics Electric Boat Division has implemented a Production Automated Design Process (PADP) with the goal of making the information available to reduce cycle time and cost, and improve product quality by integrating the engineering design process and manufacturing considerations early in the life cycle of the New Attack Submarine.

On the Joint Strike Fighter Program—extensive use has been and is still being made of modeling and simulation to perform:

- Mission area analyses
- Operational analyses
- Requirements trade-offs
- Conceptual design studies
- Systems engineering trade-offs

- Cost and operational effectiveness analyses; and
- Logistics analyses

As a result, significant commonality and life cycle cost reductions have been achieved among some seemingly disparate Air Force, Marine Corps, U.S. Navy and Royal Navy strike aircraft requirements. Our experience with the New Attack Submarine and Joint Strike Fighter programs strongly supports the view that modeling and simulation is a tool to manage program risk—both technical and operational. In this regard, I see virtual prototypes in the role of facilitating increased user involvement and early visualization of the system.

By operating virtual prototypes in a stand alone mode or connecting them to an electronic battlefield, the program manager can make an early estimate of operational effectiveness. This kind of assessment will identify system strengths and provide an opportunity to correct weaknesses at a time when the greatest amount of flexibility exists to make changes.

Models and simulations also allow the program manager to measure and track performance against milestone decision criteria. A virtual factory can be developed to evaluate the producibility of a design and initiate tooling design at an early stage of the program. By identifying the maintenance and supply requirements associated with a design, a program manager can exert positive front end control over the system's logistics "footprint" and life cycle cost.

The benefits to training are virtually unlimited. Special attention must be given to the development of training simulators that are developed in parallel with embedded training and maintenance concepts.

Since simulations could eventually be part of source selection, cost and operational effectiveness analysis and test planning and evaluation, we may need to have RFPs include identification of those models and simulations the government plans to use in evaluation, and that the industry response to the RFP include a proposed modeling and simulation plan.

Our program managers and the contractors who support them should plan on developing a simulation support plan to identify the resources required for modeling and simulation activities and ensure the acquisition strategy leverages the modeling and simulation investment. A good simulation support plan, submited in response to the RFP, will ensure that analyses are repeatable, traceable and credible. It will further demonstrate that offerors understand and have integrated the use of modeling and simulation into a life-cycle view consistent with the vision I have outlined for you today. The objective is not to add cycle time, but to reduce it by integrating modeling and simulation into the entire program. This approach will allow us to dramatically streamline a program's test and evaluation activities.

Many of our major weapons system contractors are finding that distributed

modeling and simulation tools are helping them make a needed cultural change—they are shifting from serial to integrated processes for product development and support. These suppliers are using modeling and simulation tools to help their Integrated Product and Process Development teams perform cross-functional evaluations and gain a shared vision of the system.

These suppliers have learned that the key to integrating complex systems is for the functional members of an Integrated Product Team (IPT)—design, engineering, manufacturing, logistics, product support—to understand the concerns of their counterparts and identify the technical challenges on the program as early as possible.

Use of standard, relatively inexpensive computer equipment, virtual prototypes and simulations helps to bring together a shared vision of the system and provides a means for understanding the complex interactions among the configuration items in the system design. Some studies indicate that the use of computer aided design / manufacturing (CAD / CAM) tools and common databases can result in significant manufacturing cost avoidance, including:

- 20-60% reductions in set up time
- 15-25% reductions in planned labor and tooling
- 15-75% reductions in rework and scrap
- 20-50% reductions in work-in-progress carrying cost

The real power of a computer based modeling and simulation system lies in the connection and coordination between the tools and functional users. Systems that provide a seamless environment for geographically distributed teams and a diverse set of functional users will tend to lead to cost avoidance on the higher end of the reduction ranges which I just described. In addition to increasing the effectiveness of the design and manufacturing functional specialists, the product support members of the team will benefit as well—testers, logisticians and maintainers.

The bottom line is that integrated product and process development, backed up by a strong commitment to computer based modeling and simulation tools, provides a dominant competitive edge in the commercial marketplace and a clear warfighting edge on the battlefield. It provides a path for getting to market first and at a lower cost.

SUMMARY

In summary, our challenge is clear cut—preserve and extend the supremacy of US forces in the field. Modeling and simulation is a powerful tool to help accomplish that goal. Together, with industry, the Department is committed to creating a common technical framework and infrastructure to maximize the interoperability and reuse of modeling and simulation investments.

Modeling and simulation will be used to train our forces, to aid our decision

makers, and to acquire new weapon systems. But we have only begun to exploit the power of modeling and simulation to support these objectives. I fully expect to see us reach the 1994 Defense Science Board's vision of allowing warriors to enter virtual conflict, every day, from the same seat in which they normally do their day-to-day job.

I expect to see us field complex system-of-systems architectures that provide our warrior with an overwhelming combat edge. And I know that it is going to take a team effort by industry and the DoD—using integrated product development capabilities and the latest information technologies—to field a superior capability, affordably and in less time than our potential adversaries.

I hope I have portrayed a vision that you can appreciate and will help make a reality. Let me share a thought with you from the 1968 presidential campaign of Robert F. Kennedy--Some men look at things as they are and ask *why*. Others look at things as they could be and ask *why not*. I invite you to join me in looking to the future and asking *why not*.

Thank you all.